AD-A144 201 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 1/1
BRISTOL FISH AND GAME.. (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV APR 81

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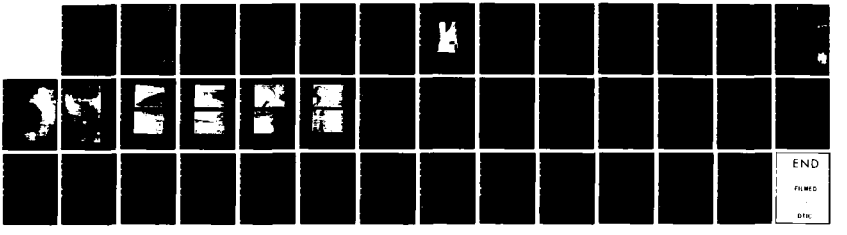

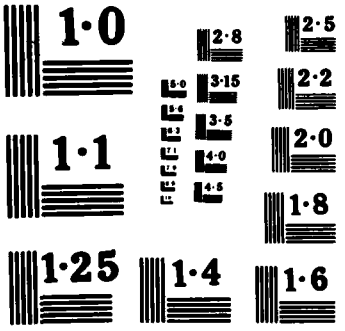
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BASIN
TOWN OF OFT

BRISTOL FISH AND GAME CLUB DAM
CT-00299
1981

NATIONAL DAM INSPECTION PROGRAM
CORPS OF ENGINEERS

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00299	2. GOVT ACCESSION NO. AD-A144201	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Bristol Fish and Game Club Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE Arpil 1981 13. NUMBER OF PAGES 45
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Quinnipiac River Basin
Town of Wolcott

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Bristol Fish and Game Club Dam is located on Cussgutter Brook in a rural area. The dam is an earth embankment founded on bedrock and measuring approximately 600 feet long, 22.5 ft. high and 12 feet wide at the top. Based on the visual inspection the project is assessed as being in good condition.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

LOW HAZARD

PHASE I INSPECTION REPORT

NATIONAL PROGRAM OF INSPECTION OF DAMS

Name of Dam:	BRISTOL FISH AND GAME CLUB DAM
Inventory Number:	CT 00299
State:	CONNECTICUT
County:	NEW HAVEN
Town:	WOLCOTT
Stream:	CUSSGUTTER
Owner:	BRISTOL FISH AND GAME CLUB
Date of Inspection:	APRIL 29, 1981
Inspection Team:	PETER M. HEYNEN, P.E.
	MURALI ATLURU, P.E.
	JAY A. COSTELLO

Bristol Fish and Game Club Dam is located on Cussgutter Brook (Quinnipiac River Basin) in a rural area in the Town of Wolcott, County of New Haven, State of Connecticut. The dam is shown on the Bristol USGS Quandrangle Map, having coordinates latitude N41°37.5' and longitude W72 56.0'. The drainage area is approximately 0.2 square miles and the maximum impoundment to the top of the dam is 130 acre-feet. Elevations given below are not NGVD, but correspond to elevations given on existing plans.

As shown on Sheet B-1, the dam is an earth embankment founded on bedrock and measuring approximately 600 feet long, 22.5 feet high (26.5 structural height), and 12 feet wide at the top. The elevation at the top of the dam is 738.5, which is 4.5 feet above the principal spillway crest. A 5 foot wide by 16 foot high bentonite clay core extends for the length of the dam. This core is placed on the bedrock foundation (elevation 712.0) and rises to elevation 728.0 along the upstream side of the cutoff trench. The upstream slope of the dam is inclined at 3 horizontal to 1 vertical and the downstream slope is inclined at 2 horizontal to 1 vertical. The slopes and top of the embankment have a grass cover, with some riprap along the waterline.

The principal spillway is a concrete drop inlet located on the upstream slope approximately 225 feet from the left end of the dam. This inlet consists of a 4 foot by 1.5 foot (I.D.) concrete riser and a 16 inch reinforced concrete outlet pipe, extending from the riser to the toe of the embankment. The riser has a crest elevation of 734.0, a bottom elevation of 720.3 and the pipe outlets at invert elevation 716.8. There are two vertical 4 foot by 1 foot openings at the top of the riser structure, which allow water to flow into the chamber and out the 16 inch RCP. The low-level outlet, also part of this spillway structure, consists of a 15 inch ACCMP which

extends [illegible] feet from the riser chamber to the toe of the upstream slope, at invert elevation 121.0. A 14 inch low-level intake valve is located just upstream of the concrete riser, and can be operated with the stem which extends to the riser hood, along the upstream side of the riser chamber.

The emergency spillway is a grass lined channel extending around the right end of the dam. The channel measures approximately 20 feet wide, with side slopes of 3 horizontal to 1 vertical and a crest elevation of 735.0. A small earth dike, measuring about 3 feet high by 80 long, extends along the left side of the spillway.

Based upon the visual inspection performed April 29, 1981, the project is assessed as being in good condition. The following features which could influence the future condition and/or stability of the dam were identified.

1. If the seepage at the toe of the dam is coming through the embankment, it could begin to carry material from the interior of the dam, creating a piping situation and thereby threatening the safety of the structure.

2. The lack of proper riprap protection on the upstream slope will lead to further sloughing and erosion of this slope, which may provide an area for overtopping during flood conditions.

3. Spalling of the concrete at the upstream and downstream sides of the riser hood at the drop inlet openings (Photo 3), could lead to failure of the hood or riser structure, possibly blocking the spillway during periods of high flows.

4. Animal burrows can provide seepage paths through the impervious core, which can promote piping and possibly lead to failure of the dam.

It is recommended that the owner retain a registered professional engineer qualified in dam design and inspection to perform services pertaining to the following items. The engineer should establish recommended corrective procedures which should then be promptly implemented by the owner.

1. Monitoring and evaluation of seepage at the toe of the embankment to determine its origin, affect on the safety of the structure, and any necessary corrective action.

2. Regrading of the upstream slope and placement of sufficient riprap to protect against erosion and sloughing of this slope by wave action. This riprap should be placed between expected high and low water elevations, and should extend around the right end of the embankment to protect against erosion should the emergency spillway be activated.

3. Repairing spalled concrete at the sides of the riser structure hood, along the waterline where water enters the drop inlet.

4. Removing trees to a distance of 10 feet from the toe of the dam with proper backfilling and replacement of protective cover.

5. Elimination of burrowing animals in the embankment, backfilling the burrows and replacement of protective cover.

Also, the owner should initiate a formal program of operation and maintenance procedures, including a monthly inspection by the owner or owner representative and proper documentation to provide accurate records for future reference. A comprehensive program of inspection by a registered professional engineer qualified in dam design and inspection should be instituted on a biennial basis.

OVERVIEW PHOTO
(April, 1981)

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	NATIONAL PROGRAM OF	Bristol Fish & Game Club Dam	Wolcott	DATE June 1981
CAHN ENGINEERS INC. WALLINGFORD, CONN. ENGINEER	INSPECTION OF NON-FED DAMS	Cussgutter Brook	CONNECTICUT	CE # 27785KH PAGE ix

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Bristol Fish & Game Club Dam DATE: April 29, 1981

TIME: 12:30 PM - 2:30 P.M.

WEATHER: Cloudy, 70°F

W.S. ELEV. 734.2 U.S. N/A DN.S

PARTY:	INITIALS:	DISCIPLINE:
1. Peter M. Heynen	PMH	Corp - Geotechnical
2. Murali Atluru	MA	DTC - H/H
3. Jay A. Costello	JAC	Cahn - Geotechnical
4.		
5.		
6.		

PROJECT FEATURE	INSPECTED BY	REMARKS
1. Embankment	PMH, JAC, MA	A-2
2. Principal Spillway (Drop Inlet)	PMH, JAC, MA	A-3
3. Auxiliary Spillway	PMH, JAC, MA	A-4
4. Outlet Structure and Channel	PMH, JAC, MA	A-5
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		

PERIODIC INSPECTION CHECK LIST

PROJECT Brookville Gun & Game Club Dam DATE Apr 2[illegible]

PROJECT FEATURE Earth Embankment BY [illegible]

AREA EVALUATED		CONDITION
DAM EMBANKMENT		
Crest Elevation		738.5
Current Pool Elevation		734.2
Maximum Impoundment to Date		Unknown
Surface Cracks		None Observed - Transverse [illegible]
Pavement Condition		N/A
Movement or Settlement of Crest		None Observed
Lateral Movement		
Vertical Alignment		Appears Good
Horizontal Alignment		
Condition at Abutment and at Concrete Structures		Good
Indications of Movement of Structural Items on Slopes		None
Trespassing on Slopes		U/s slope at riser structure
Sloughing or Erosion of Slopes or Abutments		Sloughing along waterline and u/s slope at riser structure
Rock Slope Protection-Riprap Failures		Insufficient riprap at waterline
Unusual Movement or Cracking at or Near Toes		None Observed
Unusual Embankment or Downstream Seepage		Seepage less than 5 gpm ; 20' left of outlet and 25' d/s of outlet
Piping or Boils		
Foundation Drainage Features		None Observed
Toe Drains		
Instrumentation System		

PERIODIC INSPECTION CHECK LIST

Page

PROJECT [illegible] DATE [illegible]

PROJECT FEATURE Drop Inlet Riser Structure BY [illegible]

AREA EVALUATED		CONDITION
OUTLET WORKS-CONTROL TOWER		Concrete riser structure; crest elevation = 7[illegible].0
a) Concrete and Structural		
General Condition		Fair
Condition of Joints		Good
Spalling		At each end near waterline - Concrete visible
Visible Reinforcing		None Observed
Rusting or Staining of Concrete		
Any Seepage or Efflorescence		
Joint Alignment		Appears Good
Unusual Seepage or Leaks in Gate Chamber		Not Observed
Cracks		None observed
Rusting or Corrosion of Steel		Rusting of trash rack bar
b) Mechanical and Electrical		
Air Vents		N/A
Float Wells		
Crane Hoist		
Elevator		
Hydraulic System		
Service Gates		30 foot long, 15 inch ACCMP intake with 14 inch valve enters u/s side of riser chamber at this base. Outlets by 16 inch RCP at u/s side of riser chamber.
Emergency Gates		
Lightning Protection System		N/A
Emergency Power System		
Wiring and Lighting System		

PERIODIC INSPECTION CHECK LIST

Page 1 of

PROJECT Bristol Fish & Game Club Dam DATE Apr 21 80

PROJECT FEATURE Auxiliary Spillway BY SWECO

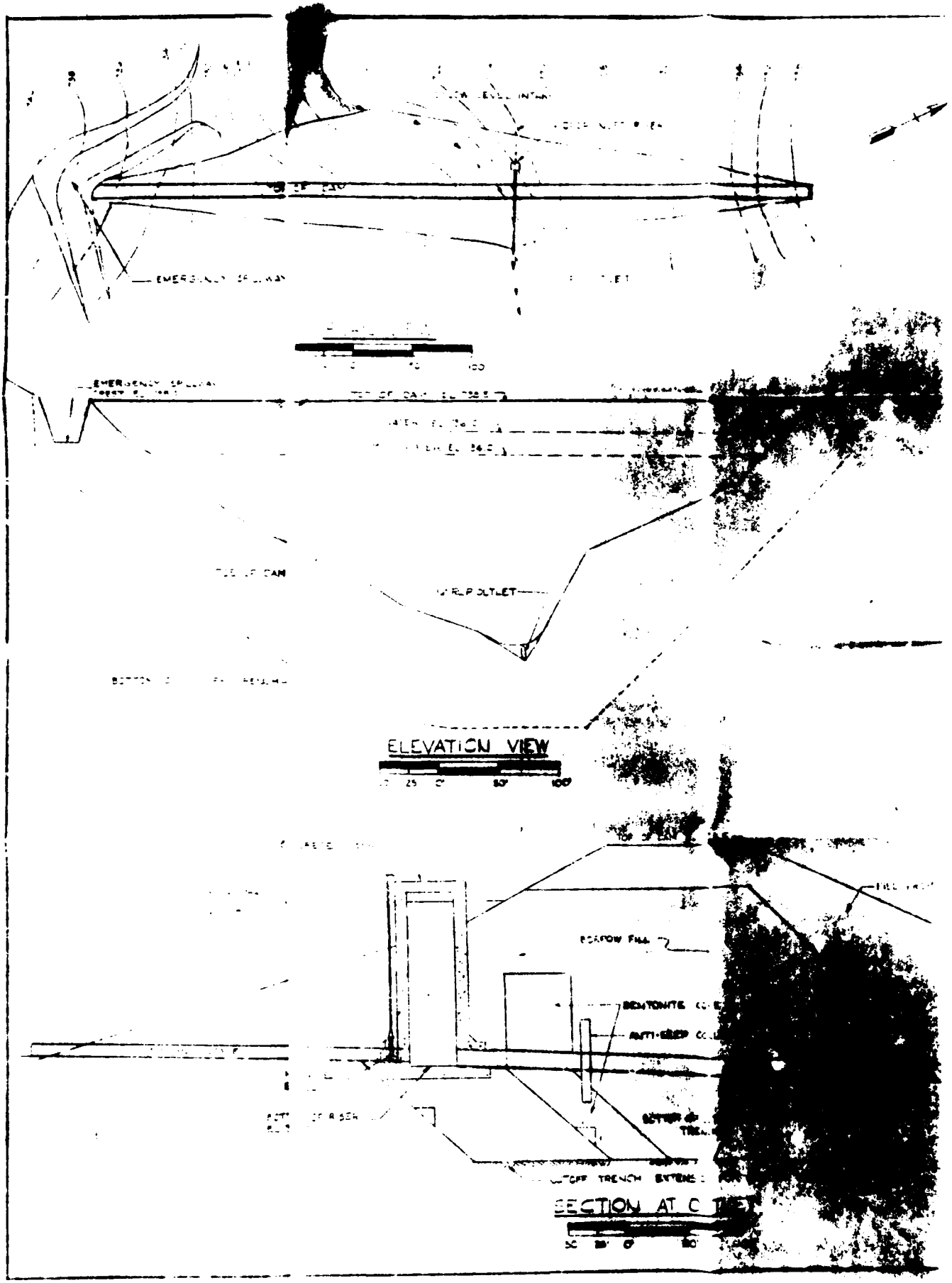
AREA EVALUATED		CONDITION
OUTLET WORKS-SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS		Grass lined earth channel @ right end of dam
a) Approach Channel		
General Condition		Good
Loose Rock Overhanging Channel		None
Trees Overhanging Channel		
Floor of Approach Channel		Flat- free of debris
b) Weir and Training Walls		
General Condition of Concrete		N/A- earth channel
Rust or Staining		grass cover - good condition, side slopes - good
Spalling		
Any Visible Reinforcing		
Any Seepage or Efflorescence		
Drain Holes		earth dike left side - good no riprap at right end dam embankment
c) Discharge Channel		
General Condition		Channel discharges to woods at right end of dam. Discharge then flows to outlet channel.
Loose Rock Overhanging Channel		
Trees Overhanging Channel		
Floor of Channel		
Other Obstructions		

PERIODIC INSPECTION CHECK LIST

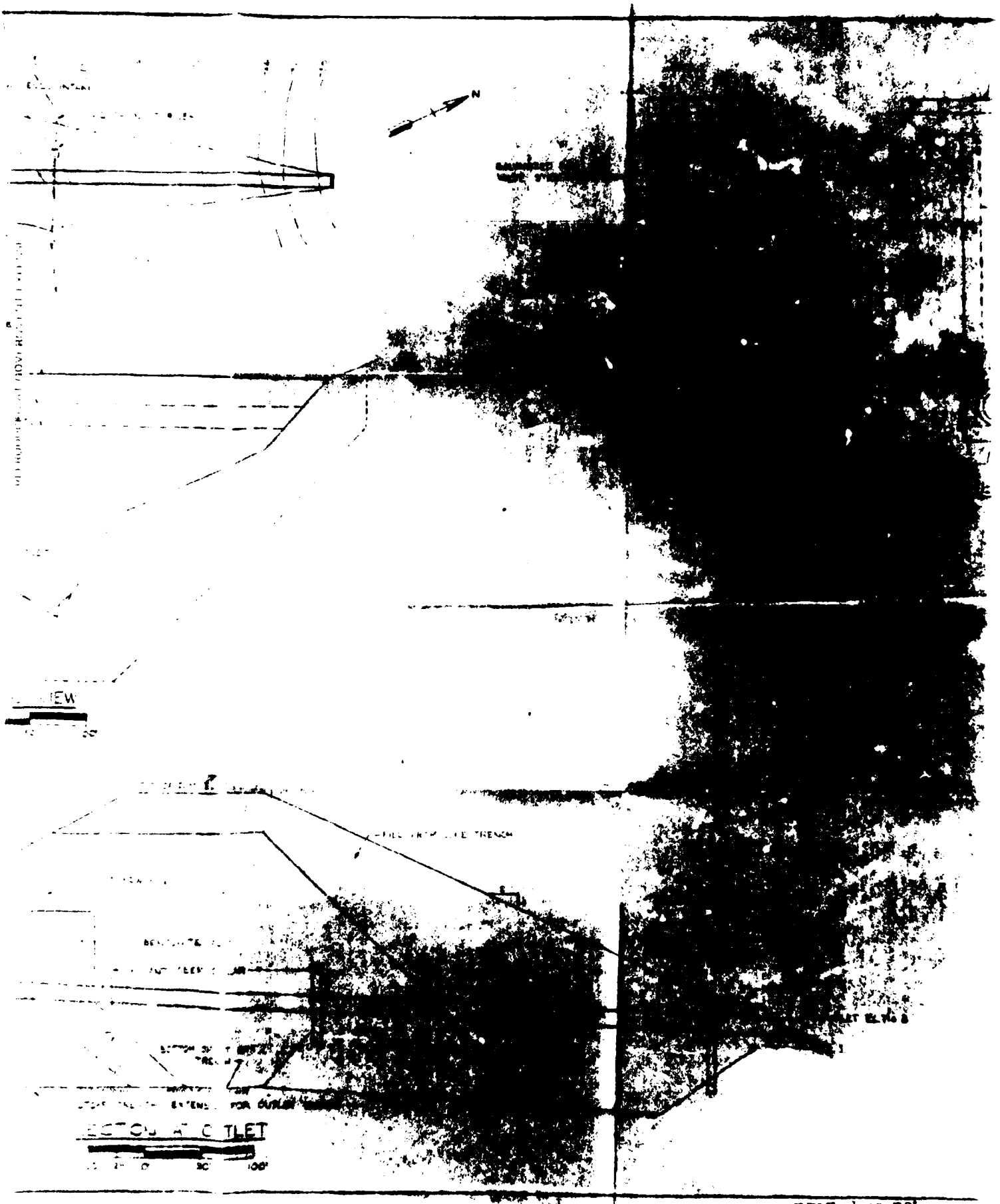
PROJECT Bristol Fish & Game Club Dam DATE April 21, 78

PROJECT FEATURE 16" RCP Outlet BY RLH, TAL, WL

AREA EVALUATED		CONDITION
OUTLET WORKS-OUTLET STRUCTURE AND OUTLET CHANNEL		16" RCP from riser chamber to d/s toe of embankment (71±')
General Condition of Concrete		Pipe appears in good condition. Hard to observe
Rust or Staining		
Spalling		N/A
Erosion or Cavitation		
Visible Reinforcing		
Any Seepage or Efflorescence		
Condition at Joints		Could not be observed
Drain Holes		N/A
Channel		
Loose Rock or Trees Overhanging Channel		Some small trees
Condition of Discharge Channel		Narrow, natural stream bed. fair condition


ELEVATION VIEW
BORROW FILL
BENTONITE
ANTI-SEEP
SECTION AT C

SECTION B



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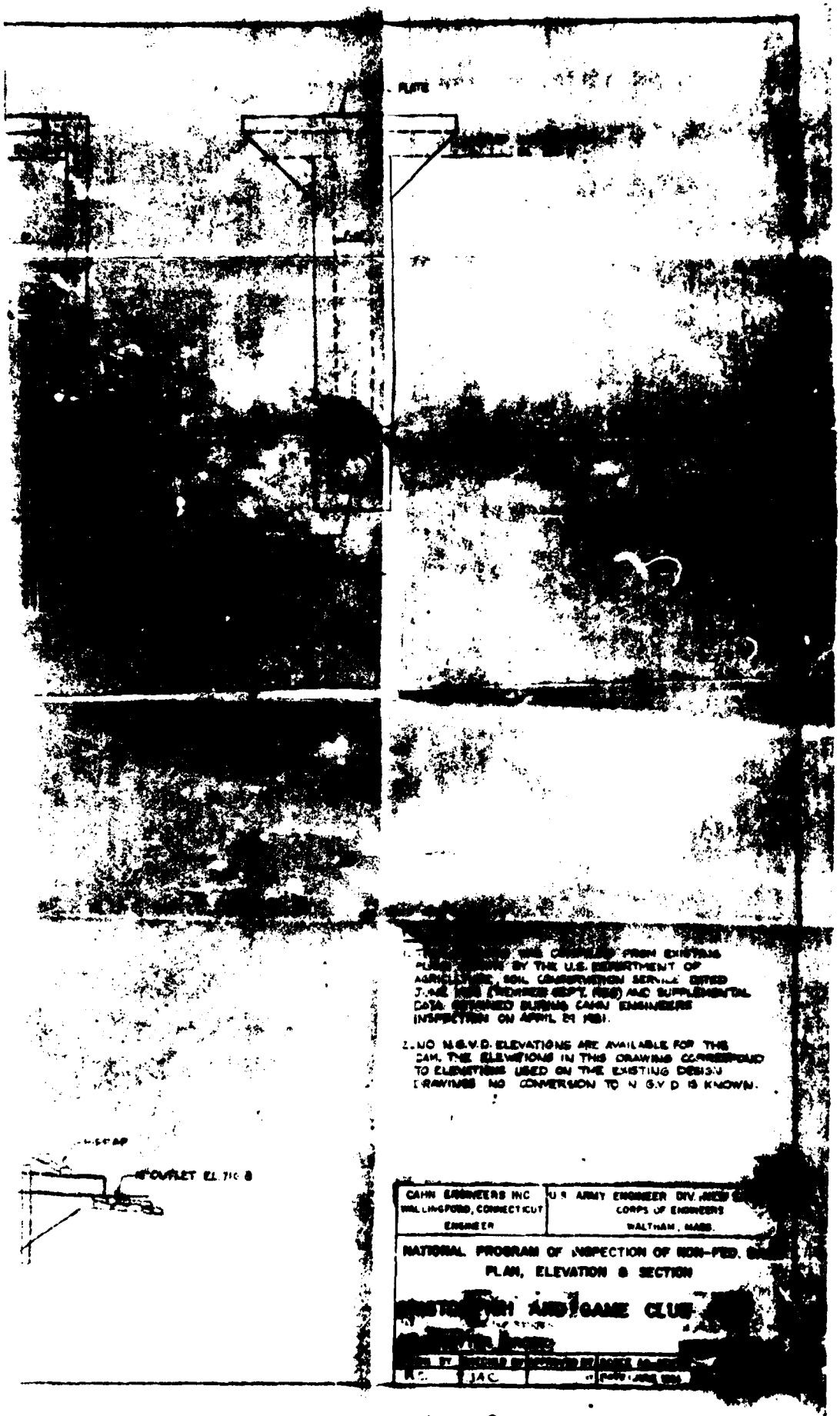

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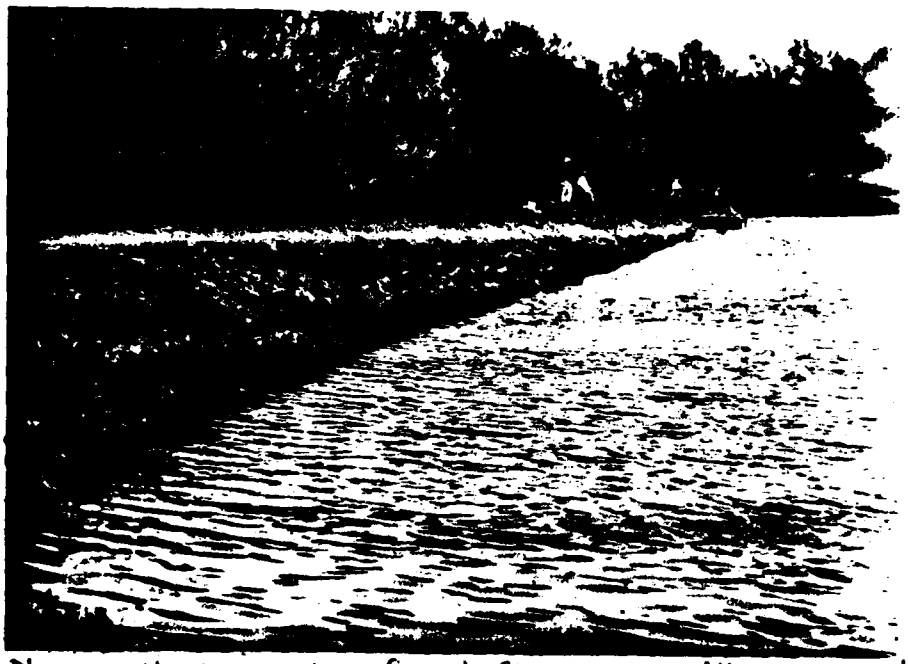


Photo 1 - Upstream slope from left abutment. Minor sloughing of the upstream slope is occuring at the waterline. Drop inlet can be seen at center of dam (April, 1981).

Photo 2 - Top of dam and downstream slope from left abutment (April, 1981).

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	NATIONAL PROGRAM OF	BRISTOL FISH & GAME CLUB CUSSGUTTER BROOK WOLCOTT, CT
CAHN ENGINEERS INC. WALLINGFORD, CONN. ENGINEER	INSPECTION OF NON-FED. DAMS	CE# 27785 KH DATE JUNE 1981 PAGE C-1

Photo 3 - Top of concrete riser structure. Casing for low-level outlet valve stem is located on upstream side of riser (April, 1981).

Photo 4 - Emergency spillway at right end of dam (April, 1981).

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS. CAHN ENGINEERS INC. WALLINGFORD, CONN. ENGINEER	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	BRISTOL FISH & GAME CLUB CUSSGUTTER BROOK WOLCOTT, CT. CE# 27785 KH DATE JUNE '81 PAGE C-2

Photo 5 – 16 inch RCP which discharges flows from the concrete riser chamber. These flows may be from the drop inlet or from the low-level intake (April, 1981).

Photo 6 – Close-up of riser structure and spalling of concrete at waterline (April, 1981).

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	NATIONAL PROGRAM OF	BRISTOL FISH & GAME CLUB CUSSGUTTER BROOK WOLCOTT, CT. CE# 27785 KH
CAHN ENGINEERS INC. WALLINGFORD, CONN. ENGINEER	INSPECTION OF NON-FED. DAMS	DATE JUNE '81 PAGE C-3

Photo 7 - Erosion and sloughing of upstream slope near drop inlet. Note sparse riprap at waterline (April, 1981).

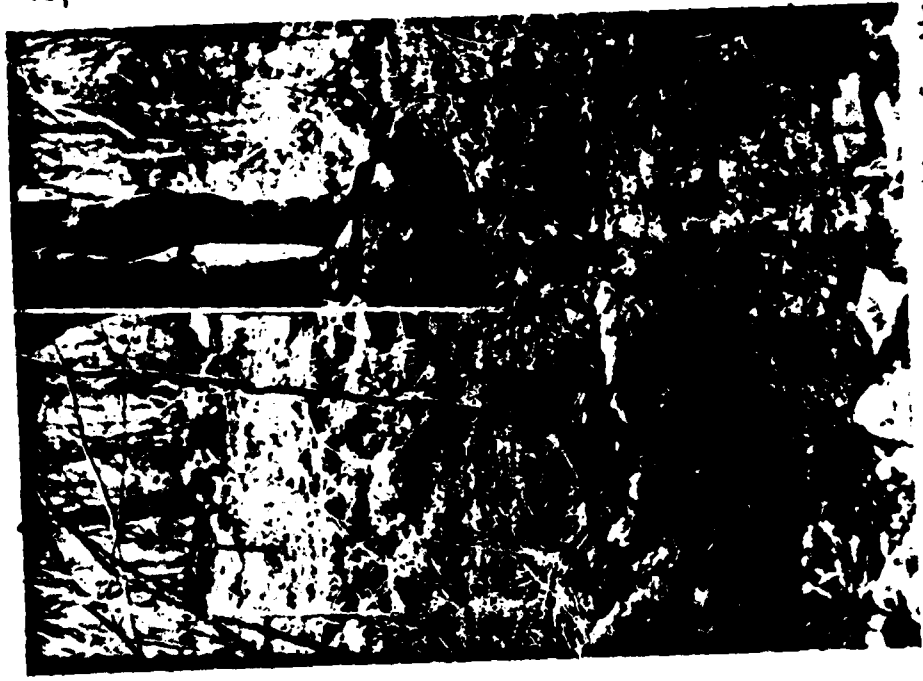
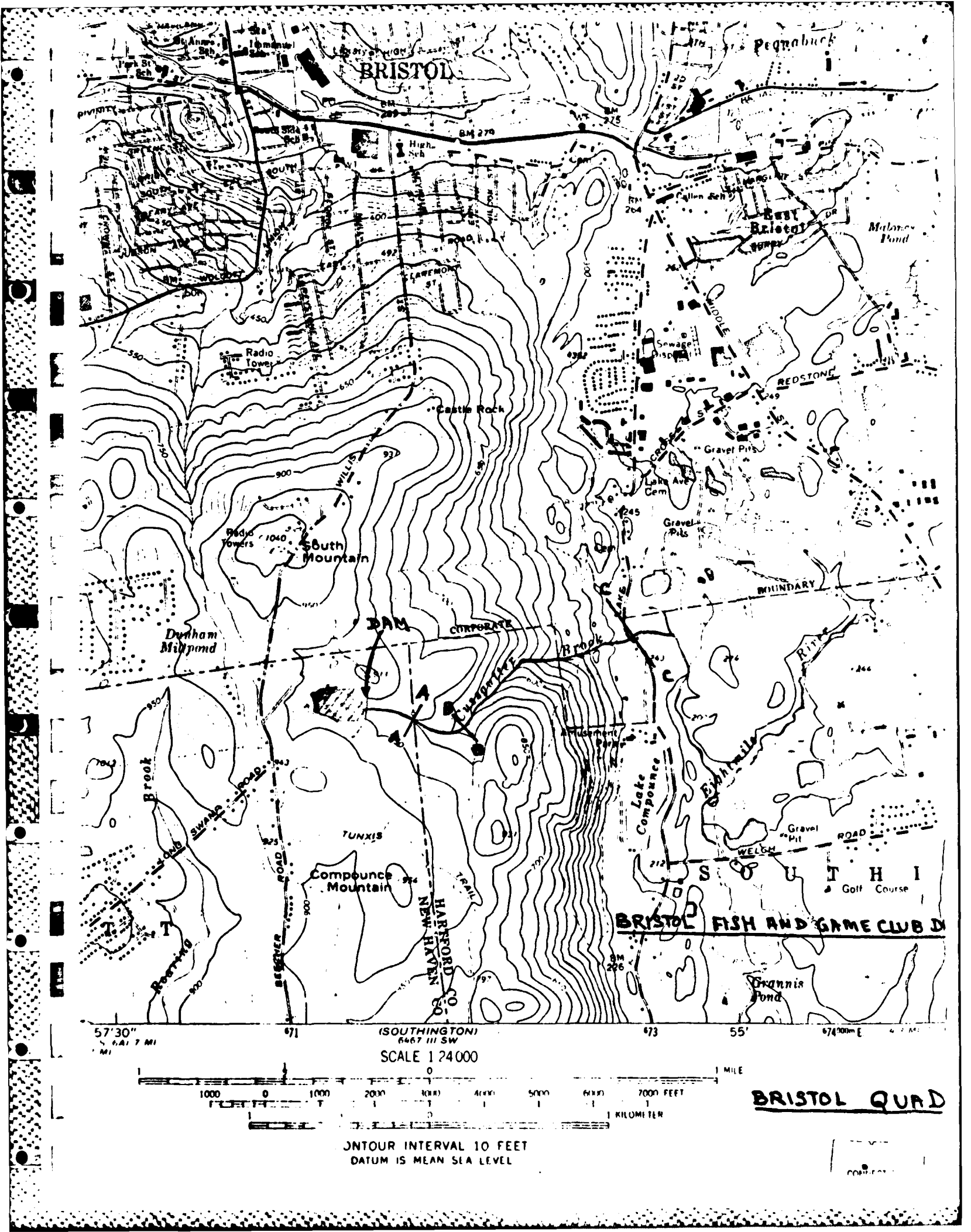


Photo 8 - Seepage at right side of outlet discharge channel. Seepage flows from wet area at toe of embankment to the right of the outlet pipe (April, 1981).

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	NATIONAL PROGRAM OF	BRISTOL FISH & GAME CLUB CUSSGUTTER BROOK WOLCOTT, CT. CE# 877065KH
CAHN ENGINEERS INC. WALLINGFORD, CONN. ENGINEER	INSPECTION OF NON-FED. DAMS	DATE JUNE '81 PAGE C-4


BRISTOL
Pequabuck
East Bristol
Mahaney Pond
Radio Tower
Castle Rock
Gravel Pits
Lake Ave Cem
Gravel Pits
Radio Towers
South Mountain
Dunham Millpond
DAM
CORPORATE
BOUNDARY
Brook
Amusement Park
Lake Compounce
Eightmile
Gravel Pit
ROAD
WELCH
Golf Course
TUNXIS
Compounce Mountain
TRAIL
HARTFORD CO.
NEW HAVEN CO.
BRISTOL FISH AND GAME CLUB
Grannis Pond
57'30"
671
(SOUTHINGTON)
6467 III SW
673
55'
674000m E
SCALE 1:24000
1 MILE
1000 0 1000 2000 4000 5000 6000 7000 FEET
1 KILOMETER
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
BRISTOL QUAD

PERFORMANCE AT PEAK FLOOD CONDITIONS

PROBABLE MAXIMUM FLOOD (PMF) DETERMINATION-

DRAINAGE AREA- 0.18 SQ.MI. PLANIMETERED FROM BRISTOL QUAD. SHEET (REV. 1972)

WATERSHED CLASSIFICATION- "ROLLING" TO "MOUNTAINOUS" BASED UPON USGS MAP AND SITE VISIT.

PMF PEAK INFLOW-

FOR SMALL DRAINAGE AREAS (< 2 SQ.MI) THE CORPS OF ENGINEERS RECOMMENDS CSM VALUES TO BE NOT GREATER THAN 2500 CFS/SQ.MI FOR THE ABOVE WATERSHED CONDITIONS.

PEAK FLOW RATE SELECTED = 2500 CFS/SQ.MI.

∴ PMF PEAK INFLOW = 2500 × 0.18 = 450 CFS

SIZE CLASSIFICATION-

FOR THE PURPOSE OF DETERMINING PROJECT SIZE, THE MAXIMUM STORAGE ELEVATION IS CONSIDERED EQUAL TO THE STORAGE AT TOP OF DAM

TOP OF DAM ELVN = 865.5*
TOE OF DAM ELVN = 843.0
HEIGHT OF DAM 22.5 FT

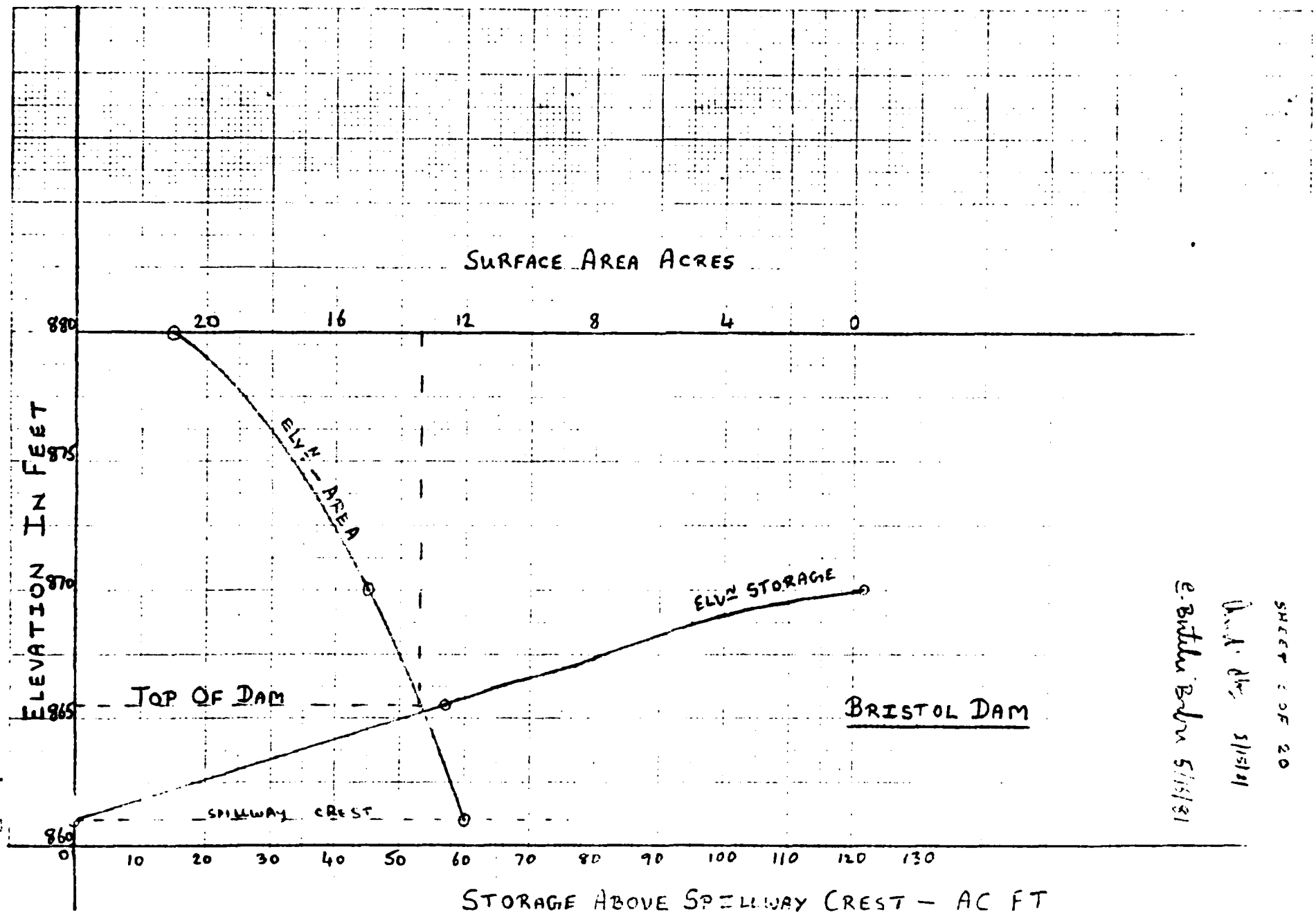
* The normal W.S elevation of the pond is not indicated on the USGS map. However, examining the contours on the USGS map as well as elevations given in the 1958 design drawings prepared by SCS, the normal pond elevation is Assumed to be 861 NGVD and is assumed to be the same for the Principal Spillway crest. All other elevations are referenced to this assumed elevation and are obtained from the 1958 SCS drawings. Cahn Inc field checked some of the key information

PLANIMETERING FROM USGS MAP FOR POND SURFACE AREAS —
AT EL 861 (PR. SPILLWAY CREST) = 12 ACRES
AT EL 870 = 15 ACRES
AT EL 880 = 21 ACRES

A STAGE-POND AREA CURVE IS PLOTTED (SHEET 3)
FROM THIS CURVE, POND AREA AT TOP OF DAM = 13.4 Ac.
AVERAGE POND AREA BETWEEN PR. SPILLWAY
CREST AND TOP OF DAM = 12.7 Ac.
∴ STORAGE BETWEEN PRINCIPAL SPILLWAY CREST
AND TOP OF DAM = $4.5 \times 12.7 \cong 57$ AC.FT.
STORAGE BETWEEN PRINCIPAL SPILLWAY
CREST AND POND AT EL 870 = 121.5 AC.FT.
EST. STORAGE BELOW PR. SPILLWAY CREST = $\frac{1}{3}bh$
$= \frac{1}{3} \times 12 \times 18$ = 72 AC.FT.

($b = 12$, h = EL. 861 − EL 843 = 18')
∴ MAXIMUM IMPOUNDMENT TO TOP OF DAM = 57 + 72
= 129 AC.FT.

A STAGE-STORAGE CURVE IS PLOTTED ON SHEET 3
THUS, ACCORDING TO CORPS OF ENGINEERS GUIDE
LINES TABLE 1, THE BRISTOL CLUB DAM IS
CLASSIFIED SMALL BASED UPON THE STORAGE
CAPACITY OF 129 AC.FT (< 1000 AND ≥ 50)
AND THE HEIGHT OF THE DAM IS ONLY
22.5 FT.



E. Bristol Dam 5/15/81

SHEET 3 OF 20

L-3

HAZARD POTENTIAL - LOW

HAZARD POTENTIAL BASED UPON DAM BREACH ANALYSIS AND ACTIVITIES BELOW THE DAM. A DETAILED DISCUSSION OF HAZARD POTENTIAL IS INCLUDED AT THE END OF BREACH ANALYSIS SECTION OF APPENDIX D.

SELECTION OF TEST FLOOD -

FOR THE SMALL SIZE AND LOW HAZARD POTENTIAL CLASSIFICATION, TABLE 3 OF CORPS OF ENGINEERS RECOMMENDED GUIDELINES, THE TEST FLOOD COULD BE IN THE 50 YEAR TO 100 YEAR FREQUENCY RANGE.

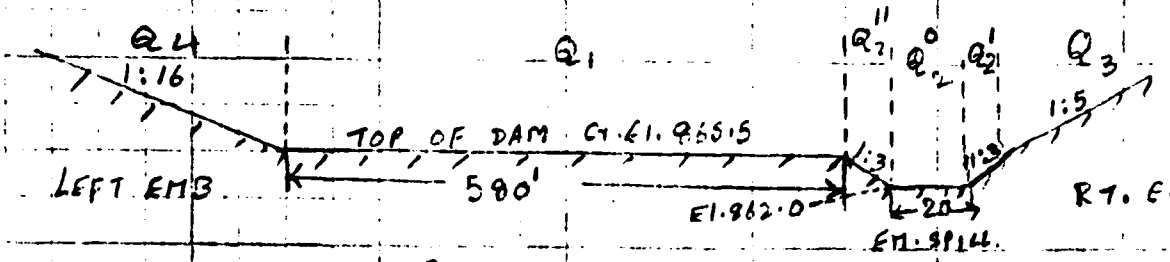
BASED UPON THE INVOLVED RISK POTENTIAL DOWNSTREAM OF THE DAM, A TEST FLOOD = 100 YR IS SELECTED.

$$\therefore \text{TEST FLOOD PEAK INFLOW} = \frac{5}{19}'' \times 450$$

$$\cong 120 \text{ CFS}$$

NOTE: PMF OF 450 CFS IS ESTIMATED TO RESULT FROM 19" RUN-OFF AND A 100 YEAR FLOOD IN CONNECTICUT IS ESTIMATED TO RESULT FROM APPROXIMATELY 5" RUN-OFF.

COMPOSITE DISCHARGE RATING CURVE



APPROXIMATE POTENTIAL OVERFLOW PROFILE

BASED ON DESIGN DRAWINGS & CAHN INC'S FIELD INFORMATION

(LOOKING DOWNSTREAM)

DAM

$Q_1 = CLH^{3/2}$

$= 1624\ H^{3/2}$

C = 2.8 ASSUMED (Earthern)
L = 580', Cr. El = 865.5

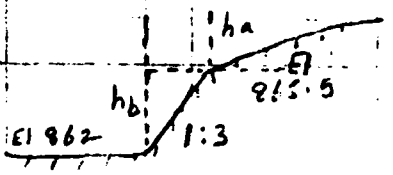
EMERGENCY SPILLWAY

$Q^0_2 = CLH^{3/2}$

$= 56\ H^{3/2}$

C = 2.8 ASSUMED (Grass)
L = 20', Cr El = 862.0

$Q'_2 = \frac{2}{5} CL (h_b - h_a)\left(h_b^{5/2} - h_a^{5/2}\right)$ *



$= 0.4 \times 2.8 \times 3 \times h_b^{5/2}$ upto El. 865.5

$= 3.36\ h_b^{5/2}$

SIMILARLY $Q''_2 = 3.36\ h_b^{5/2}$

$\therefore\ Q'_2 + Q''_2 = 6.72\ h_b^{5/2}$

* NOTE: USGS RECOMMENDED FORMULA FOR MORE PRECISE DISCHARGE OVER INCLINED DAM/EMBANKMENT CREST (REF: MEASUREMENT OF PEAK DISCHARGES AT DAM BY INDIRECT METHODS. USGS BOOK 3, CHAPTER A 5, PAGE 3-4, 1968)

PRINCIPAL SPILLWAY:

PIPE SPILLWAY WITH DROP INLET

$$Q_{ps} = a\sqrt{\frac{2gH}{1+K_e+K_b+K_p\gamma L}}$$

(Ref: "Hand Book of Applied Hydrology" by Ven Te Chow P-21-63)

FOR CONCRETE PIPE

$n = 0.015$, $K_e = 0.5$

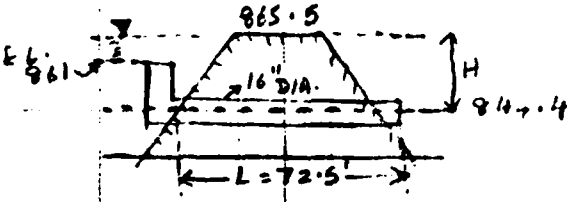
$K_b = 0$, $K_p = 0.0301$, $L = 72.5'$

Pipe diameter = 16"

Area of cross section of pipe = 1.39 Sq. Ft.

FOR FULL FLOW CONDITION

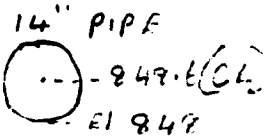
$$Q = 5.91\ H^{1/2}$$



LOWLEVEL OUTLET

$$Q_o = CA\sqrt{2gH}$$

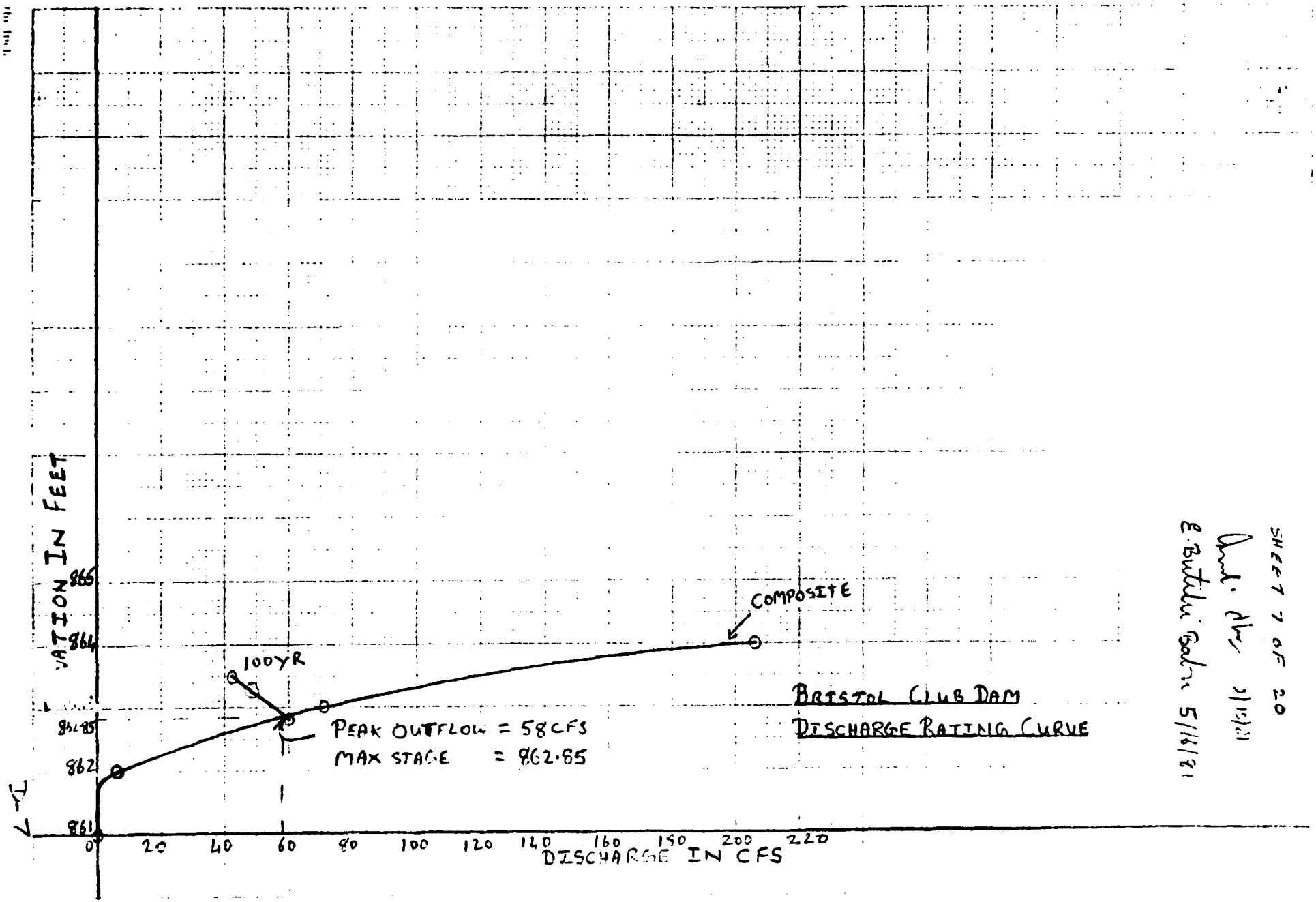
$$= 8.51\ H^{1/2}$$ = 35 CFS FOR POOL AT TOP OF DAM



THE LOW LEVEL OUTLET IS PART OF THE PRINCIPAL SPILLWAY STRUCTURE AND ITS EFFECT ON THE DISCHARGE CAPACITY OF THE SPILLWAY IS NEGLECTED. THE FLOW THROUGH THE LOWLEVEL OUTLET IS CONSIDERED INCONSEQUENTIAL IN THIS ANALYSIS, WHILE THE PRINCIPAL SPILLWAY IS OPERATING.

TABULATION OF DISCHARGE RATES (CFS)

ELVN NGVD	DAM Q_1	EMER. SPILLWAY Q_2^0	EMER. SPILLWAY $Q_2' + Q_2''$	EMER. SPILLWAY Q_2	PRINCIPAL SP. WAY Q_{ps}	TOTAL Q
PR. SPILL 861	0	0	0	0	0	0
862	0	0	0	0	6	6
TEST FLOOD 862.95	0	45	5	50	8	58
863	0	56	7	63	9	72
864	0	158	38	196	10	206



BRISTOL CLUB DAM
DISCHARGE RATING CURVE

Chuck Alm 5/19/81
E. Butkin Gates 5/19/81

SHEET 7 OF 20

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 81-20-11 SHEET 8 OF 20
NEW ENGLAND DIVISION COMPUTED BY [illegible] DATE 5/15/81
BRISTOL FISH AND GAME CLUB DAM CHECKED BY E. Butler DATE 5/16/81

DETERMINATION OF PEAK OUTFLOW -

SHORTCUT ROUTING OF POND
CORPS OF ENGINEERS GUIDELINES SURCHARGE STORAGE ROUTING ALTERNATIVE METHOD USED.
FOR 120 CFS (100 YR) THE DISCHARGE RATING CURVE GIVES ELVN : 863.5
AND FROM STAGE - STORAGE CURVE FOR THIS ELVN
STORAGE = 31 AC. FT.

$STOR_i = \frac{31 \times 12}{0.18 \times 640} = 3.23''$ RUN-OFF.

$QP_i = QP_1 \left(1 - \frac{STOR_i}{5}\right)$

① $STOR_i$ INCHES	② $\left(1 - \frac{STOR_i}{5}\right)$	③ $STOR_i$ AC. FT ① $\frac{0.18 \times 640}{12}$	④ QP_i CFS ② × 120	⑤ ELVN FROM STORAGE CURVE USING ③
2.5	0.5	24	60	862.95
3.00	0.4	29	48	863.25
3.23	0.35	31	42	863.5

COLUMNS ④ & ⑤ ARE PLOTTED ON DISCHARGE RATING CURVE AND

PEAK OUTFLOW Q = 58 CFS
MAXIMUM STAGE = 862.85 NGVD
TOP OF DAM = 865.5 NGVD

∴ THE DAM IS NOT OVERTOPPED.

BREACH ANALYSIS — DOWNSTREAM FAILURE HAZARD

BASED UPON CORPS OF ENGINEERS "RULE OF THUMB" GUIDANCE FOR ESTIMATING D/S DAM FAILURE HYDROGRAPHS

BREACH OUTFLOW $Q_b = \frac{8}{27} \times W_b \times \sqrt{g} \times Y_o^{3/2}$

HEIGHT FROM CHANNEL BED TO POOL @ TOP OF DAM Y_o = 22.5 FT.

ESTIMATED BREACH WIDTH W_b = 40% OF MID-HT LENGTH OF DAM = 0.4 × 265 = 106 FT

(MID HEIGHT LENGTH IS BASED UPON SCS DESIGN DRAWINGS)

$\therefore Q_b = \frac{8}{27} \times 106 \times \sqrt{32.2} \times (22.5)^{3/2} \cong 19{,}020$ CFS

IT IS PRESUMED THAT THE BREACH OCCURS IN DEEPEST SECTION OF THE DAM. THIS SECTION INCLUDES THE PRINCIPAL SPILLWAY AS WELL AS THE LOW LEVEL OUTLET. THE ESTIMATED DISCHARGE THROUGH EMERGENCY SPILLWAY WITH POOL AT TOP OF THE DAM: 521 CFS

$\therefore$ PEAK FAILURE OUTFLOW $Q_{P_1} = 19{,}020 + 521 \cong 19{,}600$ CFS

ESTIMATED FAILURE FLOOD DEPTH $\cong 0.44 Y_o$
IMMEDIATELY D/S FROM DAM $\cong$ 10 FT

PERFORM D/S ROUTING OF PEAK FAILURE OUTFLOW

SECTION AA IS SELECTED AT 1000 FT D/S OF DAM

$Q = \frac{1.486}{n} \times A \times R^{2/3} \times S^{1/2}$ Where n = 0.06 assumed (stones, trees, Windy) and S = 0.043 Est. from USGS map.

$= 5.136\ A R^{2/3}$

A AND R ARE ESTIMATED BASED UPON USGS MAP INFORM.

ELVN	A Sq.Ft	P	R	$R^{2/3}$	Q-CFS
800	0	–	–	–	0
802	38	38.2	0.995	0.997	195
805	237.5	95.5	2.49	1.838	2242
808	614	154.3	3.98	2.513	7925
810	950	191	4.97	2.914	14,218
811	1151	213.1	5.40	3.08	18,208
812	1372	233	5.9	3.3	23,255

FROM STAGE-AREA AND STAGE DISCHARGE CURVES

FOR Q_{P_1} = 19,600 CFS, ELVN = 811.25, AREA = 1206 Sq Ft

VOLUME OF REACH $V_1 = \frac{1000 \times 1206}{43,560} \cong 28$ AC.FT.

TRIAL $Q_{P_2} = Q_{P_1}\left(1 - \frac{V_1}{S}\right) = 19,600\left(1 - \frac{28}{129}\right) \cong 15,350$ CFS

FOR THIS Q_{P_2} THE STAGE-DISCHARGE CURVE GIVES ELVN = 810.25

AND AREA = 998 Sq.FT.

VOLUME OF REACH $V_2 = \frac{1000 \times 998}{43,560} \cong 23$ AC.FT.

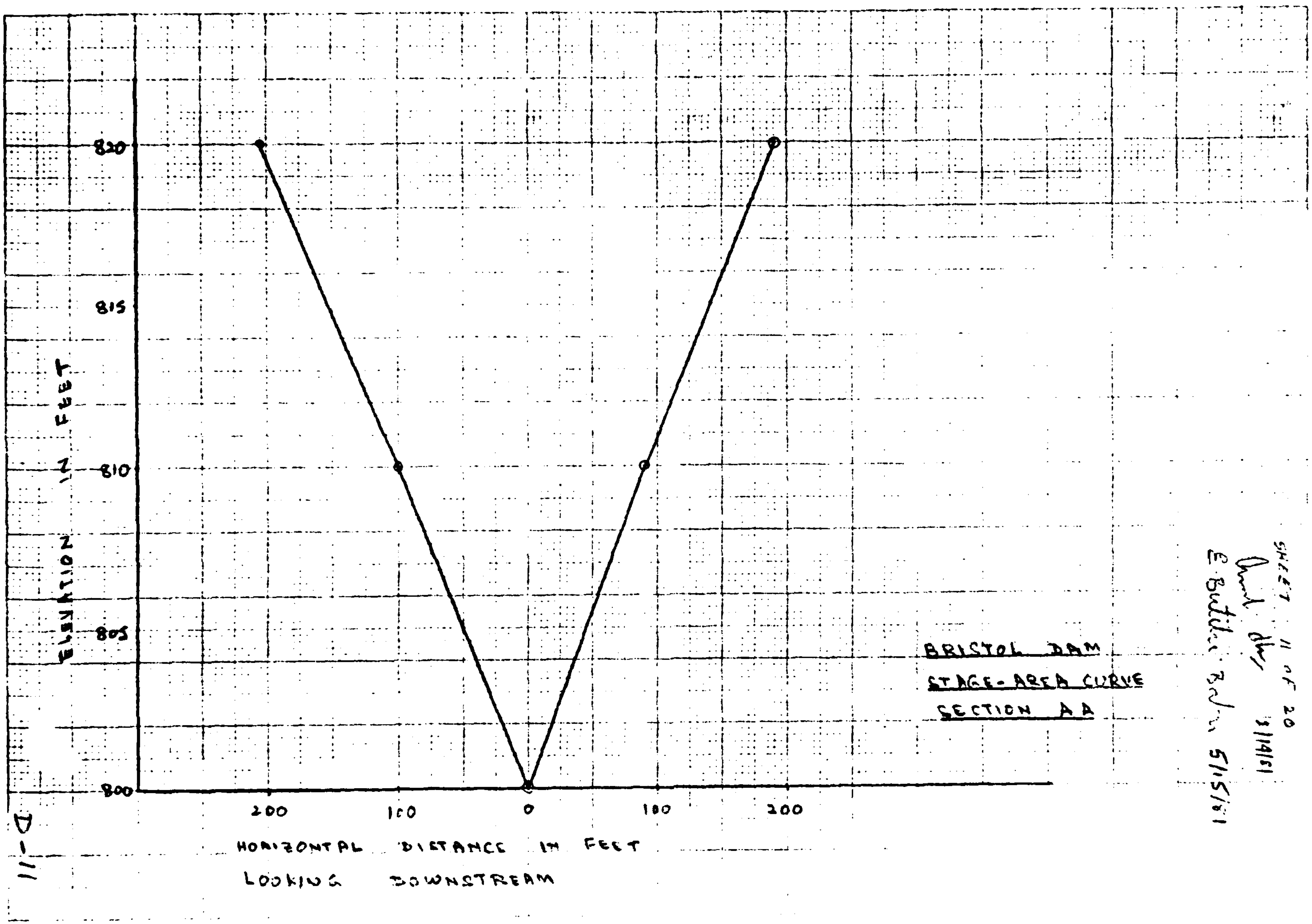
RECOMPUTING $Q_{P_2} = 19,600\left(1 - \frac{\frac{28+23}{2}}{129}\right) \cong 15,725$ CFS

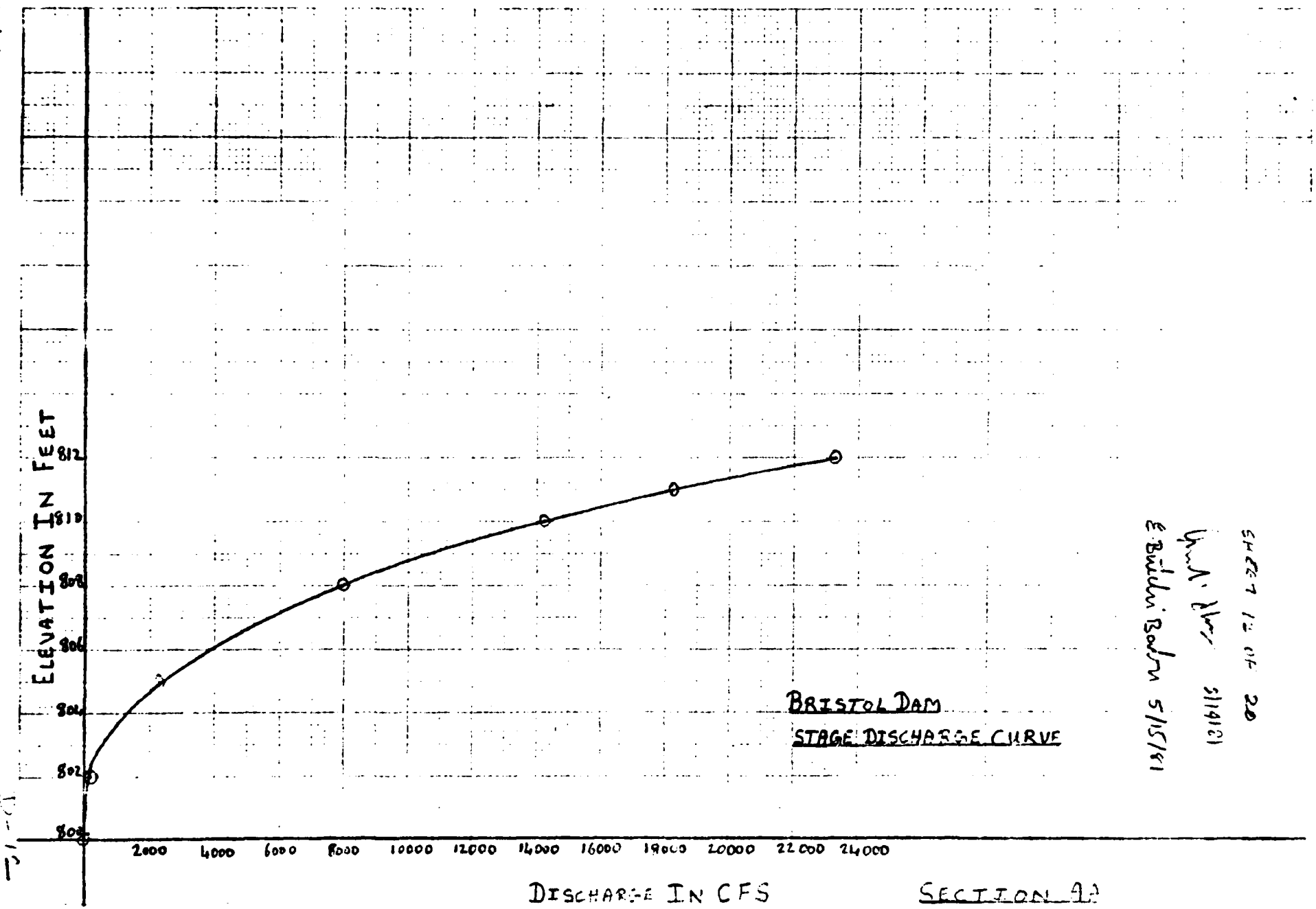
PEAK OUTFLOW Q_{P_2} = 15,725 CFS

FLOOD STAGE AT SECTION AA = 810.4 NGVD

FLOOD DEPTH AT SECTION AA = 810.4 − 800 = 10.4 FT

VELOCITY AT SECTION AA = $\frac{15,725}{1028} \cong$ 15 FPS


BRISTOL DAM
STAGE-AREA CURVE
SECTION AA
ELEVATION IN FEET
820
815
810
805
800
200
100
0
100
200
HORIZONTAL DISTANCE IN FEET
LOOKING DOWNSTREAM
SHEET 11 OF 20
3/14/81
5/15/81



BRISTOL DAM
STAGE DISCHARGE CURVE

SECTION A-2

SHEET 12 OF 20

Hyd. Mech. 5/19/61
& Bldg. Branch 5/15/61

D-12

SELECTING A SECTION BB 900' D/S OF SECTION AA

$Q = \frac{1.486}{n} \times A \times R^{2/3} \times S^{\frac{1}{2}}$ where $n = 0.06$ assumed
$S = 0.07$ based on USGS map

$= 6.553\, A R^{2/3}$

ELVN	A	P	R	$R^{2/3}$	Q
730	0	—	—	—	0
734	185	92.85	1.992	1.584	1920
736	418.5	140.02	2.989	2.076	5693
738	740	185.7	3.985	2.515	12,196
740	1150	230.9	4.981	2.918	21,990

STAGE AREA AND STAGE DISCHARGE CURVES ARE PLOTTED -
FOR $QP_1 = 15,725$ CFS, ELVN = 738.8, AND AREA = 899 SQ FT.

VOLUME OF REACH $V_1 = \frac{900 \times 899}{43,560} \cong 18.5$ AC·FT

TRIAL $QP_2 = QP_1 \left(1 - \frac{V_1}{S}\right) = 15,725 \left(1 - \frac{18.5}{129}\right) = 13,470$ CFS
FOR 13,470 CFS, ELVN = 738.35 AND AREA = 810 SQ. FT.

VOLUME OF REACH $V_2 = \frac{900 \times 810}{43,560} \cong 16.75$ AC·FT

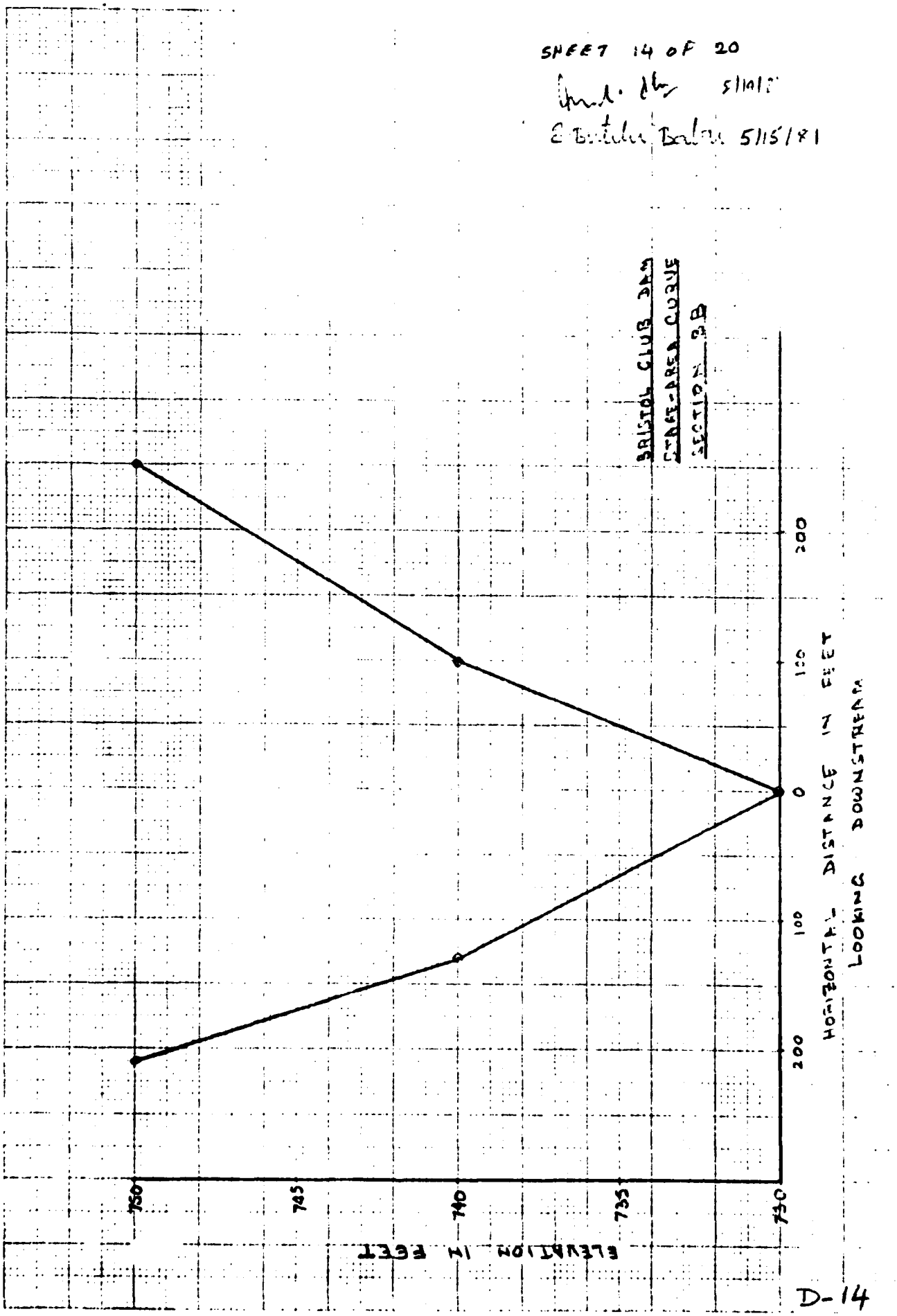
RECOMPUTING $QP_2 = 15,725 \left(1 - \frac{\frac{18.5+16.75}{2}}{129}\right) \cong 13,575$ CFS

PEAK OUTFLOW $QP_2 = 13,575$ CFS
FLOOD STAGE AT SECTION BB = 738.41 NGVD
FLOOD DEPTH AT SECTION BB = 738.4 − 730 = 8.4 FT
VELOCITY AT SECTION BB $= \frac{13,575}{819} \cong 16.5$ FPS

SHEET 14 OF 20

5/14/81

E Bartlett Bates 5/15/81



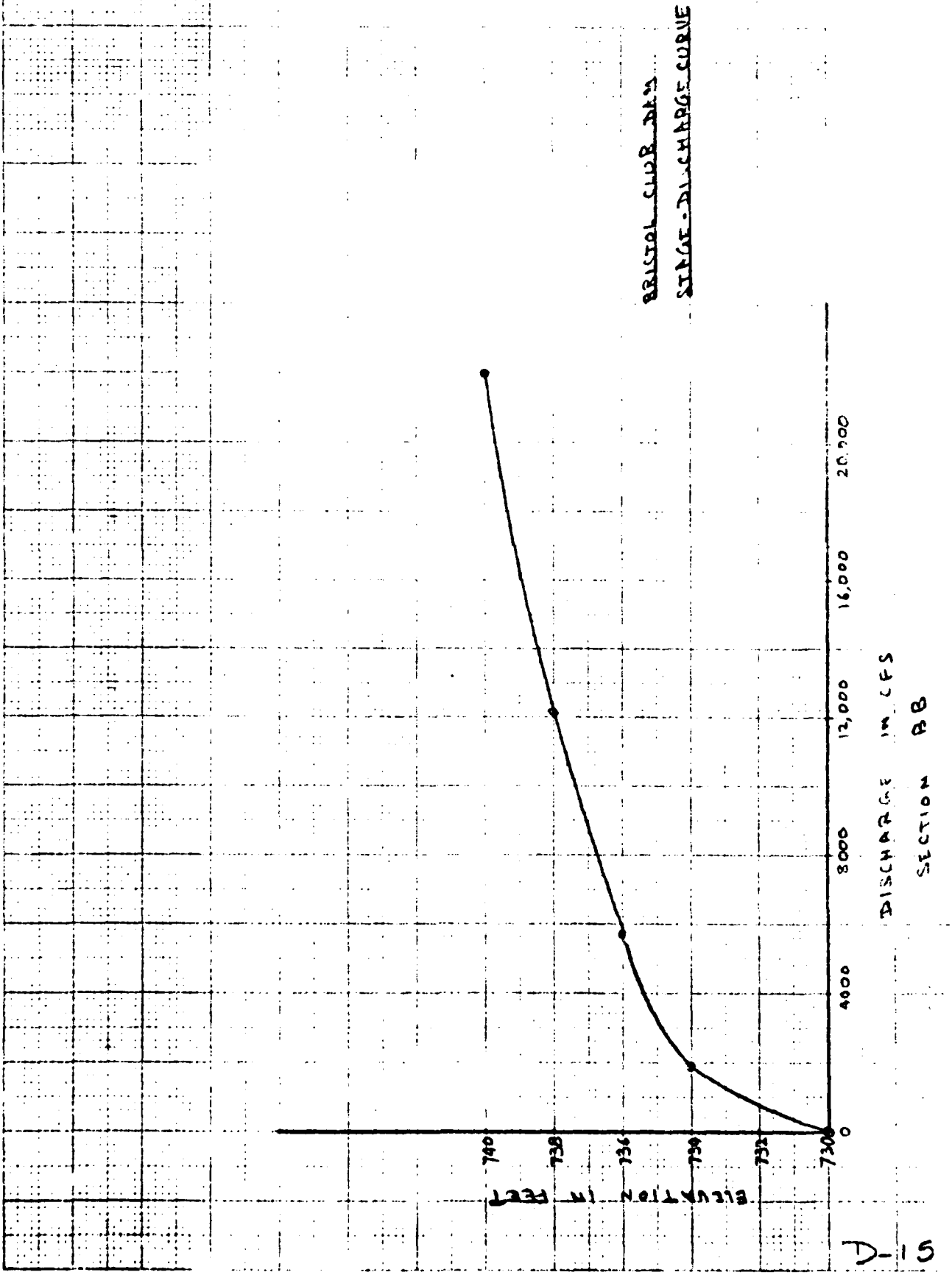
SHEET 15 OF 20

5/19/21

E Batista Bolton 5/15/21

BRISTOL CLUB DAM

STAGE-DISCHARGE CURVE



D-15

SELECT A SECTION CC 3700' D/S OF SECTION BB

A CONSIDERABLE REACH LENGTH (3300'±) BELOW SECTION BB IS EXTREMELY STEEP AND NARROW. THEREFORE, ATTENUATION OF STORAGE VOLUME IS CONSIDERED NEGLIGIBLE. THE REACH LENGTH USED IN THIS ANALYSIS IS THEREFORE 400'.

$$Q = \frac{1.486}{n} \times A \times R^{2/3} \times S^{1/2}$$
$$= \frac{6.443}{n} A R^{2/3}$$

Where n = 0.05 assumed
S = 0.047 Est. from USGS map.

ELVN	A sq FT	P	R	$R^{2/3}$	Q CFS
230	0	—	—	—	—
232	210	210	1	1	1350
234	820	410	2	1.59	8400
235	1312	525	2.5	1.84	15,555

STAGE AREA AND STAGE DISCHARGE CURVES ARE PLOTTED

FOR QP_1 = 13,575 CFS, ELVN = 234.75 & AREA = 1188 Sq. Ft.

VOLUME OF REACH $V_1 = \frac{400 \times 1188}{43,560} \cong 11$ AC·FT

TRIAL $QP_2 = QP_1 \left(1 - \frac{V_1}{S}\right) = 13,575 \left(1 - \frac{11}{129}\right) \cong 12,400$ CFS

FOR 12,400 CFS, ELVN = 234.6 & AREA = 1104 Sq Ft

∴ VOLUME OF REACH $V_2 = \frac{400 \times 1104}{43,560} \cong 10$ AC·FT

RECOMPUTING $QP_2 = 13,575 \left(1 - \frac{\frac{11+10}{2}}{129}\right) \cong 12,400$ CFS.

PEAK OUTFLOW QP_2 = 12,400 CFS

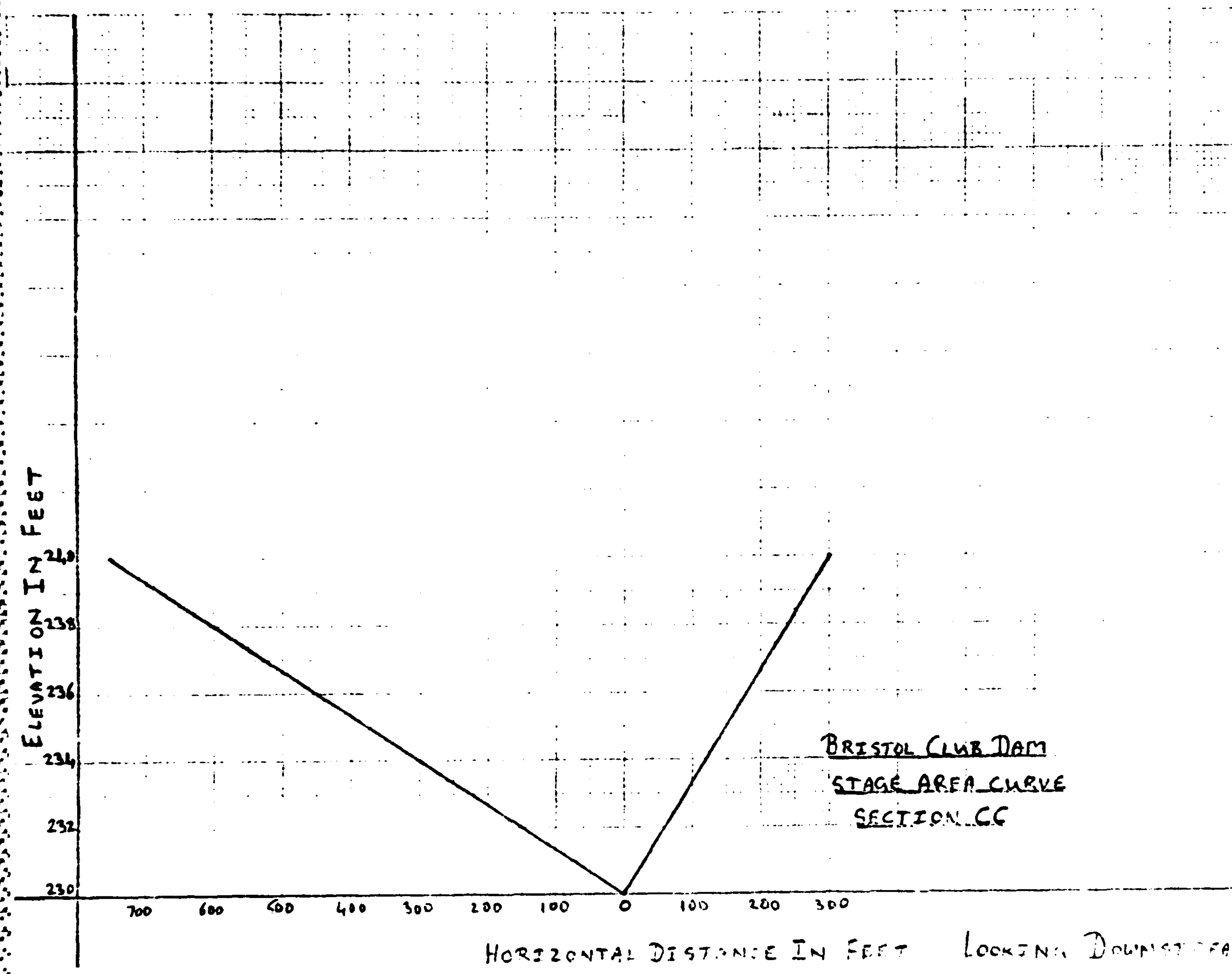
FLOOD STAGE AT SECTION CC = 234.6 NGVD

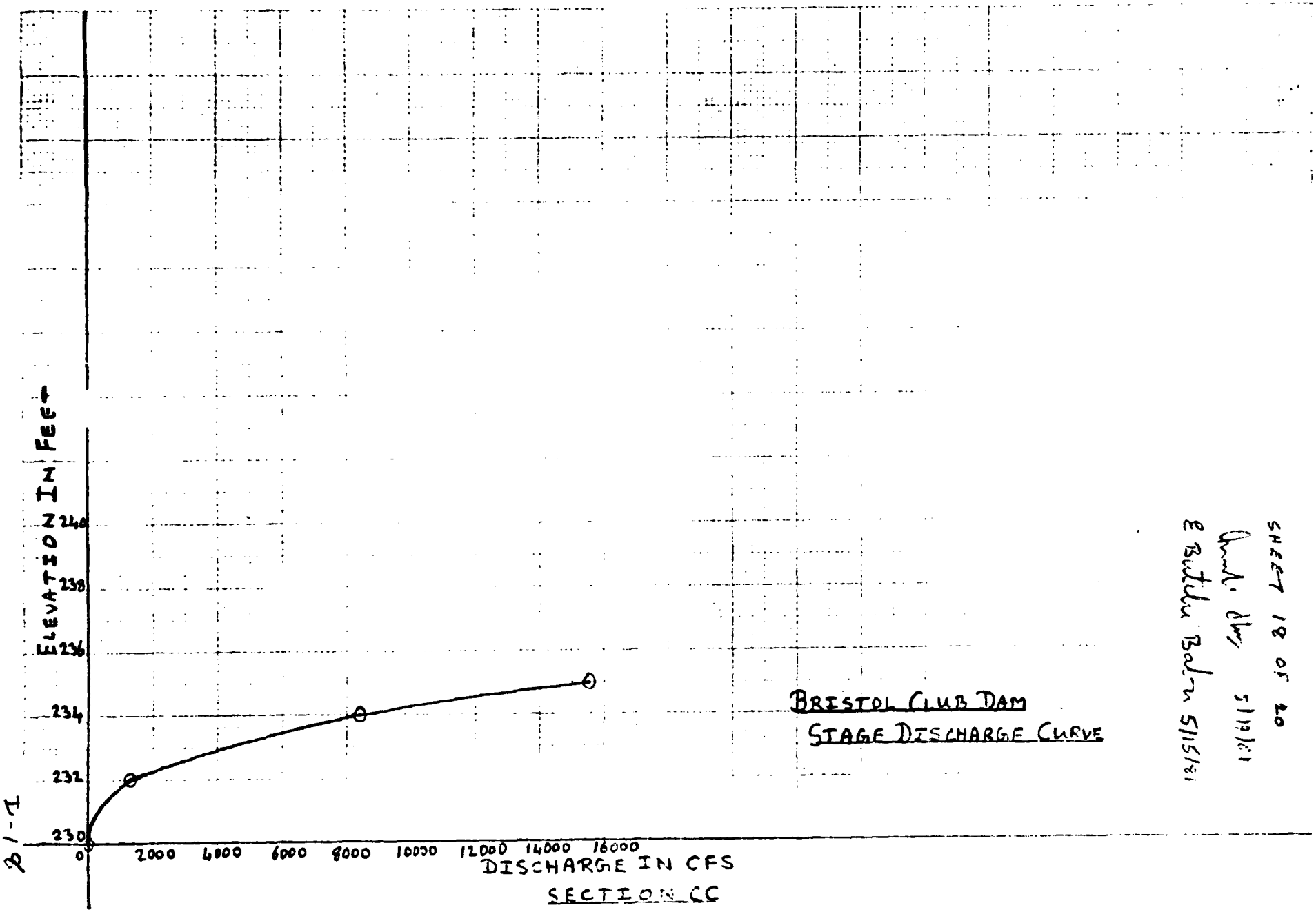
FLOOD DEPTH AT SECTION CC = 234.6 − 230 = 4.6 FT

VELOCITY AT SECTION CC = $\frac{12,400}{1104} \cong$ 11 FPS

5/19/81

5/15/81


BRISTOL CLUB DAM
STAGE AREA CURVE
SECTION CC
ELEVATION IN FEET
240
238
236
234
232
230
700
600
500
400
300
200
100
0
100
200
300
HORIZONTAL DISTANCE IN FEET LOOKING DOWNSTREAM



BRISTOL CLUB DAM
STAGE DISCHARGE CURVE

SECTION CC

SHEET 18 OF 20

Chas. Alvey 5/19/81
E Butler Balto 5/15/81

T-1
8/

FAILURE HAZARD POTENTIAL

BASED UPON THE EXISTING INFORMATION, THE LOWEST SECTION OF THE DAM APPEARS TO BE IN THE VICINITY OF THE PRINCIPAL SPILLWAY WITH LOW LEVEL OUTLET AND HENCE IT IS PRESUMED THAT BREACH OF THE DAM WOULD OCCUR IN THIS VICINITY.

THE FAILURE ANALYSIS WAS PERFORMED WITH POOL AT TOP OF DAM (EL. 865.5 NGVD).

SUMMARY OF BREACH ANALYSIS RESULTS:

LOCATION	DISTANCE FROM DAM, FT	PEAK FLOW RATE, CFS	FLOOD STAGE, NGVD	FLOOD DEPTH, FT	VELOCITY FPS
DAM	0	19,600	853.0	10.0	—
AA	1000	15,725	810.4	10.4	15
BB	1900	13,575	738.4	8.4	16.5
CC	5600	12,400	234.6	4.6	11

A CONSIDERABLE PORTION OF THE CUSSGUTTER BROOK DOWNSTREAM OF THE DAM TRAVERSES THROUGH THE BRISTOL FISH AND GAME CLUB PROPERTY AND HUNTING, FISHING AND HIKING ACTIVITIES TAKE PLACE IN THIS REACH. AT DAM BREACH CONDITION, THE FLOOD DEPTHS IN THIS REACH IS ESTIMATED TO BE 10.4 FT (SECTION AA) AND 8.4 FT (SECTION BB) WITH VERY HIGH VELOCITIES (15-16.5 FPS).

FURTHER, DOWNSTREAM, THE BRIDGE ON LAKE AVE. WITH AN OPENING OF 3'x11' IS LIKELY TO BE IMPACTED WITH HIGH VELOCITY (11 FPS) FLOW OF 12,400 CFS. IN ADDITION, THERE ARE 3 HOUSES ADJACENT TO THE BROOK ON LAKE AVE. WITH 1ST FLOOR ELEVATIONS BETWEEN 7' TO 8.5', WHICH COULD HAVE SOME CELLAR FLOODING.

SINCE, OVERNIGHT CAMPING ON CLUB PROPERTY IS NOT PERMITTED, LOSS OF LIFE FROM DAM FAILURE IS UNLIKELY. HENCE, A HAZARD POTENTIAL OF LOW MAGNITUDE IS CONSIDERED LIKELY.

SUMMARY- HYDRAULIC/HYDROLOGIC COMPUTATIONS

PERFORMANCE AT PEAK FLOOD CONDITIONS

TEST FLOOD	100 YR
PEAK INFLOW	120 CFS
PEAK OUTFLOW	58 CFS
PRINC. SPILL.CAP TO TOP OF DAM (EL.865.5 NGVD)	27 CFS
PRINC. SP. CAP. TO TOP OF DAM % OF PEAK OUTFLOW	47
PRINC. SP. CAP. TO PEAK FLOOD ELVN 862.85 NGVD	8 CFS
PRINC. SP. CAP. TO PEAK FLOOD ELVN % OF PEAK OUTFLOW	14
EMERGENCY SP. CAP. TO PEAK FLOOD ELVN	50 CFS
EMERGENCY SP. CAP. TO PEAK FLOOD EL % OF PEAK OUTFLOW	86

PERFORMANCE:	
MAXIMUM POOL ELVN	862.85 NGVD
MAX. SURCHARGE HEIGHT ABOVE PRINC. SP. CREST	1.85 FT
NON-OVERFLOW SCETION OF THE DAM OVERTOPPED	NO

DOWNSTREAM FAILURE CONDITIONS

PEAK FAILURE OUTFLOW	19,600 CFS
FLOOD DEPTH IMMEDIATELY D/S FROM DAM	10 FT
CONDITIONS AT THE IMPACT AREA: SECTION CC (LAKE AVE) (STREAM BED EL. 230)	
EST. STAGE BEFORE FAILURE	230.4 NGVD
EST. STAGE AFTER FAILURE WITH 12,400 CFS	234.6 NGVD
EST. RAISE IN STAGE AFTER FAILURE ΔY_1	4.2 FT

END

FILMED

10-84

DTIC